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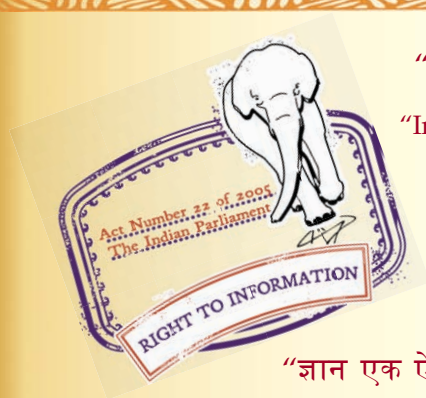
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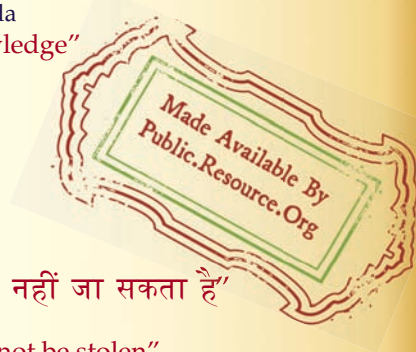
IS 9495 (1980): Test for brazeability of brazing alloys
[MTD 11: Welding General]



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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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Indian Standard

TEST FOR BRAZEABILITY OF BRAZING ALLOYS

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TEST FOR BRAZEABILITY OF BRAZING ALLOYS

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Indian Standard

TEST FOR BRAZEABILITY OF BRAZING ALLOYS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 22 April 1980, after the draft finalized by the Welding General Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 When designing and making a brazed joint, apart from the physical properties which may be expected from the joint, it is important to know its brazeability as a function of the operating conditions adopted. The determination of weldability has already been the subject of numerous investigations and proposals regarding testing methods.

0.3 In investigating the brazeability the most frequently used methods are based on the spreading of a drop, or on the measurement of surface tension, but they in fact, only take into account one element of the problem. It is important to know not only the way in which the liquid filler metal wets the surface of the parent metal, but also how this same liquid filler metal behaves in a given gap between the joint components when diffusion takes place.

0.4 The test piece described in this standard gives guidance about the effects of brazing variables on filler metal flow when capillary gaps of different dimensions are used.

0.5 This standard is based on the Draft ISO Proposal 'Investigation of brazeability using a varying gap test piece', [Doc: ISO/TC 44/SC 3 (Sect-158) 223] issued by the International Organization for Standardization.

0.6 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS:2-1960*.

1. SCOPE

1.1 This standard specifies the technique of using a varying gap test piece to know the influence of various parameters during brazing operations.

*Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS:812-1957* shall apply.

3. TEST PIECE

3.1 The varying gap test piece shown in Fig. 1 shall consist of the following (see Fig. 1):

Outer tube *A* — External diameter 18 mm (approximate)
— Internal diameter 14 mm
— Length 80 mm

Inner tube *B* — External diameter 13.5 mm
— Internal diameter 10 mm (approximate)
— Length 80 mm

Cup *C* — At the bottom of the test piece

3.1.1 Two adjustment screws press the inner cylinder *B* against the inner wall of the outer cylinder *A* in such a way that on the cross section of the assembly the gap varies from 0 to 0.5 mm over half of the circumference.

3.1.2 It is necessary that there is a gap between the base of the inner tube *B* and Cup *C* to allow the filler metal to flow into the capillary gap between tubes *A* and *B*.

4. TEST PARAMETERS

4.1 The following parameters shall be considered before conducting the test:

Parent material — Light alloys, copper and its alloys, mild low alloy and stainless steels, etc

Surface condition — Various machine finishes, surface roughness effects, chemical and other cleaning, plating, etc

Filler metals — Silver based, copper based, nickel based, noble metal based, etc

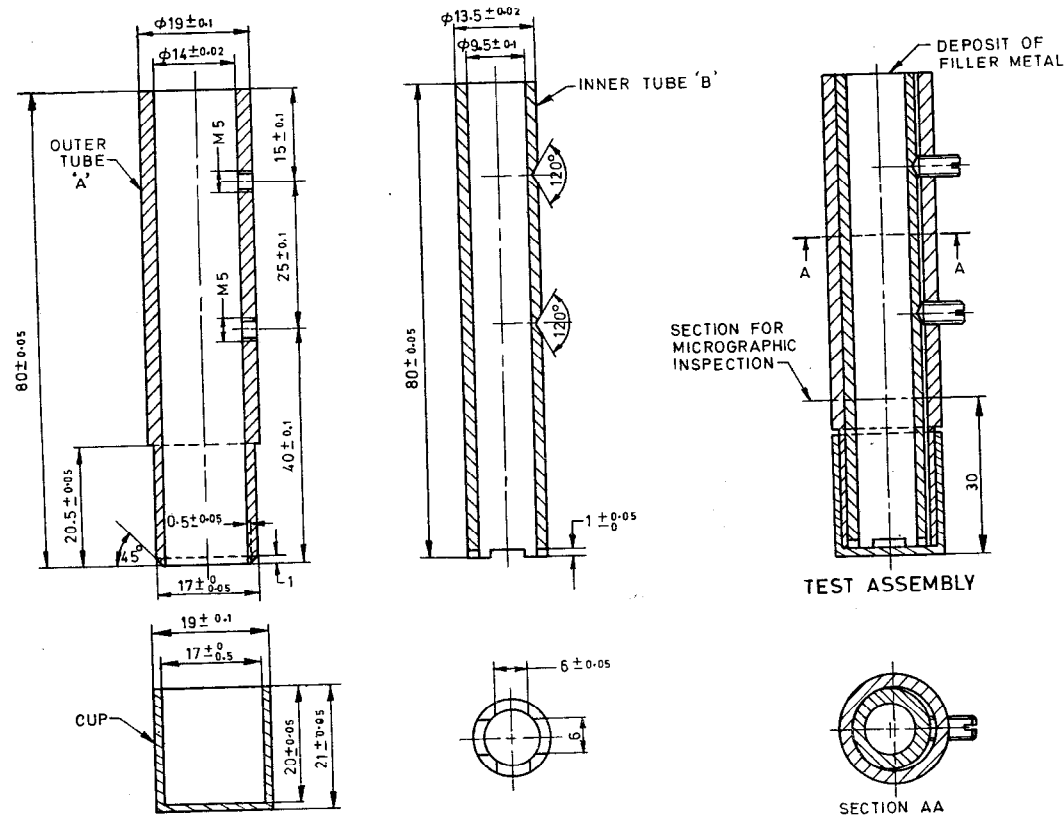
Flux — Various types of flux

Atmosphere — Air, hydrogen, vacuum, cracked ammonia

Method of heating — Torch, furnace induction, infra red, etc

Heating cycle — Degree of superheat, time at temperature, time to reach temperature

*Glossary of terms relating to welding and cutting of metals.



The bottom end of tube B has four identical and centered toes of height equal to 1 ± 0.05 mm obtained by machining as per sketch for a width of 6 ± 0.05 mm.

FIG. 1 VARYING GAP TEST PIECE

5. TEST PROCEDURE

5.1 Test Assembly — After degreasing, where required, the test piece components shall be assembled as shown in Fig. 1. About 1 400 mm³ of filler metal and wherever necessary the appropriate quantity of flux, are introduced into the gaps of the test piece varying from 0 to 0.5 mm.

5.2 Brazing Cycle — The assembly is then heated to the appropriate temperature using the selected method of heating. The filler metal rises by capillary action in the space between the two components of the test piece. It is important that a uniform temperature be achieved over the whole sample unless variation in temperature is a factor being investigated. The maximum temperature achieved by the sample shall be recorded using a thermocouple. The factors such as rate of rise of temperature and variation of temperature shall be recorded.

6. INSPECTION OF TEST PIECE

6.1 Radiographic Examination — The assembly shall be radiographed along two perpendicular axes (*see* Fig. 2). The height of the liquid metal rise is then measured on the films and the values thus obtained are plotted against angle (hence the perimeter) on a developed diagram shown in Fig. 2. A micrographic inspection of the top portion of the test piece will enable accurate measurement of the rise of filler metal.

6.2 Micrographic Inspection — Micrographic inspection is carried out on a section taken at right angle to the axis of the test piece at a point 30 mm above the base (*see* Fig. 1) to assess the flow of filler metal at this point. Micrographic inspection may be carried out on more sections taken at various distances from base to collect more data. The width of the filler metal shall be measured and other features such as filler metal alloying and grain boundary penetration into the parent metal shall be investigated. The inspection shall be completed by measuring the hardness at the weld metal and heat affected zones.

By carrying out several micrographic tests the following can be investigated:

- a) Performance of the parent metal;
- b) Surface condition of the parts to be brazed;
- c) Type of flux or atmosphere; and
- d) Method and condition of heating (rate of filling, temperature rise, time, rate of cooling, etc).

7. TEST RESULTS

7.1 The results can be conveniently tabulated as shown in Fig. 3. The table can be extended to include other variables investigated.

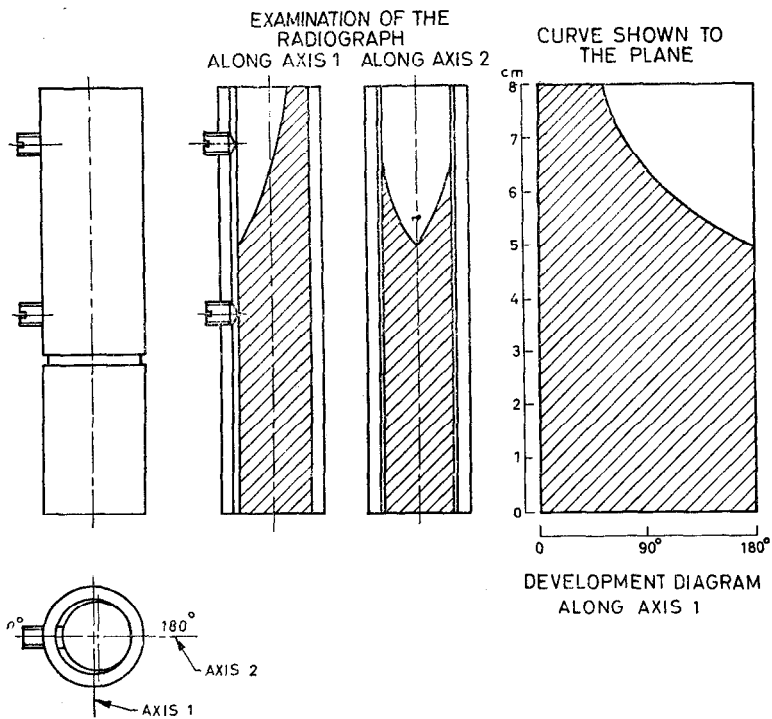


FIG. 2 RADIOGRAPHIC EXAMINATION

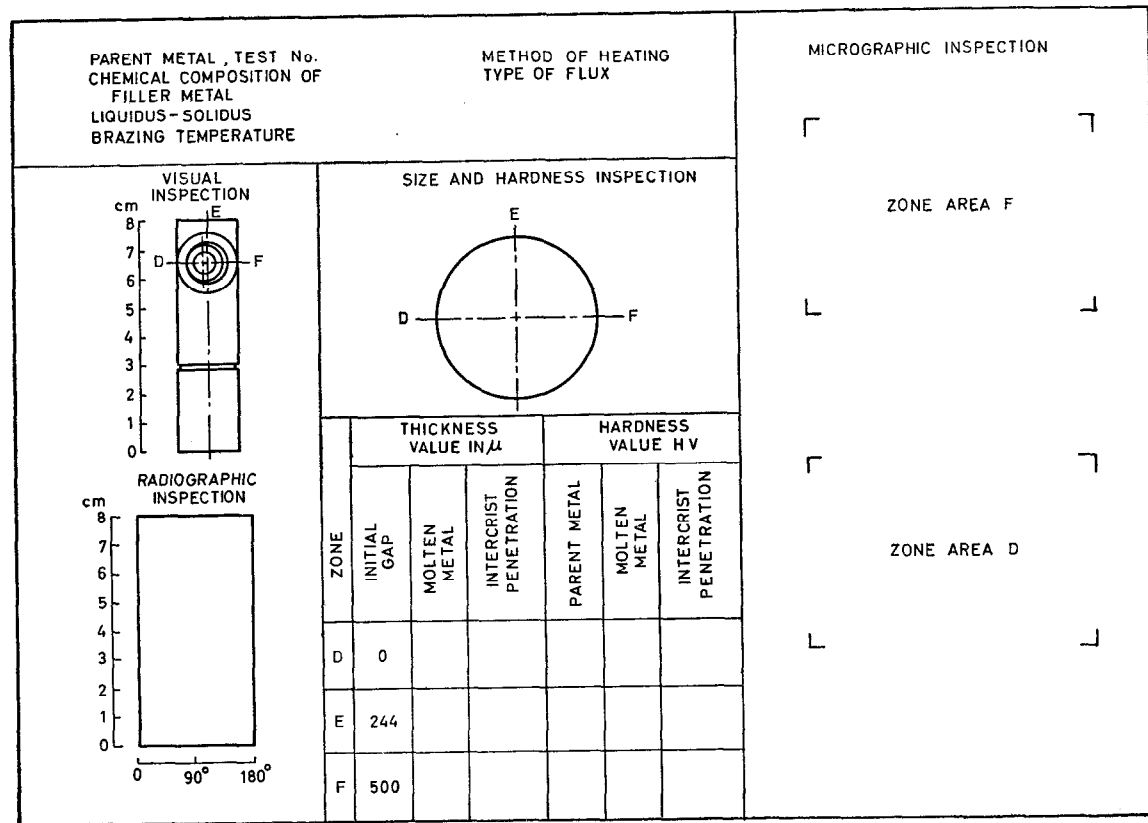


FIG. 3 PRESENTATION OF RESULTS

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Definition</i>
Force	newton	N	1 N=1kg. m/s ²
Energy	joule	J	1 J=1 N.m
Power	watt	W	1 W=1 J/s
Flux	weber	Wb	1 Wb=1 V.s
Flux density	tesla	T	1 T=1 Wb/m ²
Frequency	hertz	Hz	1 Hz=1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S=1 A/V
Electromotive force	volt	V	1 V=1 W/A
Pressure, stress	pascal	Pa	1 Pa=1 N/m ²